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GROWTH-STAGES OF THE BLASTOID, *OROPHOCRINUS STELLIFORMIS*

F. A. BATHER, F.R.S.

British Museum (Natural History), London

The references to literature are given in the *List of the Genera and Species of Blastoidea in the British Museum*, 1899.

Among the specimens entered in that *List* are some referred by Etheridge & Carpenter to *Orophocrinus stelliformis* (E 840 and E 1055), which, however do not agree well with the description by those authors or with the original figures of the species, but seem to agree more nearly with the form which Etheridge & Carpenter distinguish as var. *campanulatus* Hambach.

A set of sixteen specimens collected by Mr. D. K. Greger in the Lower Burlington Limestone at White Ledge, Marion Co., Missouri, and presented to the British Museum in 1918 by the late Dr. G. B. Longstaff (E30091-30106), if arranged in order of size, shows a complete transition from the *campanulatus* form to the typical *stelliformis*, the latter being the larger. The dozen or so specimens previously in the museum fit into their places in this series. There can therefore be no doubt that the alleged species or variety *O. campanulatus* is merely the young of *O. stelliformis*.

Apart from mere size the growth-changes consist in:

1. An increase in the greatest diameter as compared with the height of the theca.
2. The lowering of the ambitus from a position but little below the oral pole to one less than half the height of the theca from the base.
3. A consequent change from a tumbler outline, through a bell outline, to a parachute outline, the sides changing from straight, or in part convex, to concave, and the summit changing from almost flat to flattened-convex or convex.

4. With the extension of the ambulacra in length, the radials grow outward, and the cross section at the ambitus becomes more stellate.

5. Concurrently the number of ambulacrals (side-plates, etc.) increases.

6. A change in the outline of the ambulacra outside the deltoids from broadly lanceolate, through narrowly lanceolate, to the characteristic outline of the adult, which is broad in the proximal region, then rather rapidly tapering to a region from one-third to two-thirds the distance from the proximal end, then narrow and gently tapering.

7. The distal region of the ambulacrum is in all stages depressed below the edges of the radial sinus, but the proximal region, which in the young is flush with the sinus, gradually rises above it, until in the largest individuals it projects conspicuously; and this projecting portion increases in length, until it nearly (though never quite) attains the distal lip of the sinus.

8. Concomitantly with the preceding change, the edges of the sinus become sharply beveled, and the two beveled faces of adjacent limbs of the radials meet in a ridge on the deltoid.

9. The curve of the side of the theca below the ambitus, though described above as straight or concave, is never a simple curve, but consists of three parts: (*a*) the almost vertical sides of the basal circlet, (*b*) the outwardly spreading lower part of the radials, which is straight or feebly convex, (*c*) the part of the radials below the lip, which in the young bends outward almost imperceptibly, but gradually lies at a sharper angle to region *b*, until it is at last horizontal.

10. The distal parts of the radial above this region *c* come to be marked off from the body of the radial by a vertical depression, which at its upper end meets the distal end of the beveled surface mentioned under (8).

11. Various changes of proportion in details are scarcely worth setting out, since all follow from the one great change, namely the extension of the ambulacra outward, arching upward, and bending downward, unaccompanied by equally rapid growth of the other elements.

It follows from the preceding that such a description as that given by Etheridge & Carpenter for *O. stelliformis* could not apply even to all the forms which they themselves labeled with that name. Some of the necessary modifications will be gathered from what has been said. There are other variations which may be mentioned.

The deltoids are said to be constricted at one-third of their length from the proximal end. In the large E 30091 the measurements are 4.6/8.4 mm., i.e., more than one-half. In the medium-sized E 30099 they are 1.8/3.8 mm., i.e., rather less than one-half. In the smallest E 30106 they are 1.1/1.9 mm.

The anal deltoid is said to have its distal margin rounded. This seems to be the case in the two specimens from Burlington registered E 841, as also in E 30096; but in most of the specimens the sutures are straight, and, even when curved, nearly always meet in a decided angle.

The number of side-plates on each side of an ambulacrum is given as fifty, on the authority of Meek & Worthen. It did not reach this number in any of the specimens before Etheridge & Carpenter. In E 1055 the total is thirty-five or less. In those registered E 840, the total is forty or less, and in one case twenty or less. In E 8172a, it is about twenty-five; and in E 8172b, about forty. In the very young E 30106 from White Ledge, the number is about nine. From this it increases to fifty in E 30093, sixty in E 30092, and something over sixty in E 30091. In E 842b, referred to var. *campanulatus* by Etheridge & Carpenter, the number is thirteen or fourteen, and was probably the same in E 482a. In all individuals the number of side-plates to 3 mm. is nine or a fraction more.

The ornament, when preserved, as in E 30094, consists, on the radials, of the usual growth-lines; these also occur on the upper part of the basals, but on their lower part, where the basals form a cylinder, the lines are coarse, irregular, and rugose.

The cover-plates pass right up to the oral pole in E 30099, apparently without fusion or enlargement. Since no one has ever doubted that they could open on the ambulacra, there is no reason why precisely similar plates should not have opened over the mouth. Possibly these plates may have fused over the mouth in some

individuals, as supposed by C. A. White, Meek & Worthen, and Etheridge & Carpenter. In E 30106 they are not preserved, but the notches indicating a mobile articulation extend round the peri-stone; in so young a form one would not expect these plates to have been fused.

The new material shows no traces of plates covering the anal aperture, or of facets for plates of a tube raised above it as suggested by Etheridge & Carpenter.

The horizon of all specimens in the British Museum is given as Lower Burlington. I do not find either the species or its supposed variety recorded from any other horizon. It would, however, be interesting to work out its vertical distribution with more accuracy, and to see whether the earlier representatives are closer to the tumbler or bell-form of the smaller, and supposed younger, individuals in our series; and whether the later representatives are closer to the parachute-form of the larger, and supposed older, individuals.